



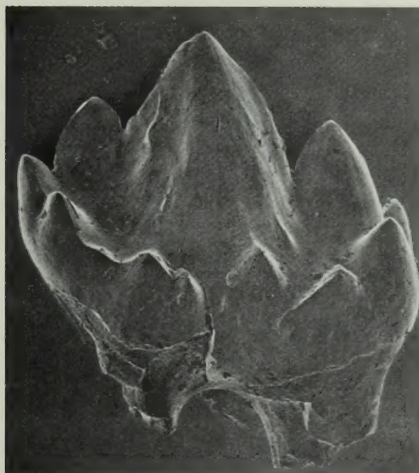


Harvard University  
Cambridge, Massachusetts  
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# MCZ newsletter

MUSEUM OF COMPARATIVE ZOOLOGY

## Earliest Mammal Tooth Found



*The earliest mammal tooth found in North America will be exhibited in the new Romer Hall of Vertebrate Paleontology. (Enlarged 45 x.)*

The earliest known mammal tooth from North America, from a tiny shrew-like insectivore, was found last summer in the Kayenta formation in northeastern Arizona by paleontologist **William R. Downs** of the Museum of Northern Arizona.

MCZ paleontologists had been working in the rugged terrain of this area for three years. While they had uncovered fossil remains of ornithiscian dinosaurs, ancient turtles, and mammal-like reptiles, evidences of the earliest mammals had eluded them. Teeth from this earliest mammal, known as *Eozostrodon*, had previously been found in England, Wales, the Yunnan province of China, and southern Africa. Last fall, Downs visited one of the MCZ localities and backpacked out some 300 pounds of rock. At the Museum of Northern Arizona Labs he employed vari-

ous techniques to break down the matrix and then used heavy liquid to separate bone fragments from sand grains. He found four teeth floating on the top, including the 1.2 millimeter prize tooth.

Finding the first tooth will hopefully lead to more early mammal finds. The MCZ team of paleontologists, including Professor **Farish A. Jenkins, Jr.**, **Charles Schaff**, **William Amaral**, and former graduate student **Dr. Kathleen Smith** (now Assistant Professor of Anatomy at Duke University Medical Center) will continue the search this summer with the support of a grant from the National Geographic Society.



Photo by Farish A. Jenkins, Jr.

*Patient paleontologists look for fossil remains in northeastern Arizona.*

## Romer Hall Progressing



Photo by George Sheng

*The Kronosaurus, perhaps the most spectacular exhibit in the MCZ, is the focus of the Romer Hall of Vertebrate Paleontology.*

An ambitious project to transform the current vertebrate fossil evolution exhibition area into the Romer Hall of Vertebrate Paleontology was launched in March. The design stage of this two-year project, which will cost about \$100,000, is nearly complete and by the end of the summer several important exhibits, including the coelacanth and the triceratops, will be in place. Fundraising efforts are paralleling the exhibition work; generous Friends of the MCZ have contributed \$34,000 as of May 15 and the current intermediate goal is \$45,000 by June 30.

The new exhibit hall will serve a variety of audiences: students will be able to see actual specimens upon which much of current paleontological knowledge is based; the general public will gain an overview of the whole field of evolutionary biology; and younger visitors will be introduced to the concept of the enormous span of geologic time and the changes that have led to life as we know it today.



# First Tetrapod Symposium Held at MCZ

The first symposium on *Problems in the Evolution of Paleozoic Tetrapods* was held in the MCZ on March 13 and 14. Organized by Curatorial Assistant Dr. **Donald Brinkman**, the fourteen speakers included six scientists from the United Kingdom and four from Canada. Papers were presented on four topics: the origin of tetrapods and the early evolution of the braincase and stapes; interrelationships of amphibians; the origin of reptiles; and the interrelationships of pelycosaurs.

More of a workshop than a symposium, the meeting gave participants the unique opportunity to

discuss evolutionary questions while examining the actual fossil material since much of the work on tetrapods is based on Professor A. S. Romer's fossil finds from the Texas Red Beds and are in the MCZ's Vertebrate Paleontology collections. Former MCZ Director Romer's influence also lives on through his students Professors Keith Thomson (Yale) and Robert Carroll (McGill) who gave papers, and their students. Three of Carroll's students participated, including organizer Brinkman.

One of the keys to sorting out amphibian relationships is contained in the origin of the stapes

(middle ear). From among the collections at the University, Newcastle-Upon-Tyne, UK, Dr. Jennifer Agnew recognized the stapes of an antherasaur, an amphibian which roamed the earth 300 million years ago, and a significant new piece in the puzzle. The specimen had been collected in the 1800's. This is not an uncommon occurrence; more than one-third of the MCZ's fossil collections are "unprepared" (still in the rock matrix in which they were found, unsorted, and unidentified), waiting for future generations of students to discover.

## Visiting Researcher

This spring's Visiting Alexander Agassiz Professor is Dr. **Geoffrey Goldspink**, Professor of Zoology at the University of Hull. A specialist in muscle physiology, Dr. Goldspink gave a five-part seminar on the subject in April for faculty and students.

Using the Concord Field Station facilities, Dr. Goldspink is studying the recruitment of different kinds of muscle fibres during locomotion and measuring the amount of energy used by the different types of muscle fibres. There is a possible application of this research to the

eventual control of muscular diseases such as muscular dystrophy. Striated muscles can either contract slowly or quickly. Long distance runners have slow contracting muscles, enabling them to withstand fatigue, while fast runners have fast contracting muscles. It is now known that slow contracting muscles are not affected by dystrophy. Dr. Goldspink's goal is to find out what determines fibre type and how different fibres are used in locomotion in a variety of animals ranging from fish to humans.

## Staff Notes

Professor **Stephen Jay Gould**, Curator of Invertebrate Paleontology, has won the 1981 American Book Award in science for *The Panda's Thumb*. He has also been awarded a "scholar's dream": five years of support at \$40,000 a year with no strings attached from the John D. and Catherine T. MacArthur Foundation of Chicago. The MCZ also receives \$15,000 a year overhead. Dr. Gould, who will accompany the Friends of the MCZ tour of the Galapagos Islands in July, plans to use the free time to write a book on evolutionary theory.

Assistant Professor **Ronald J. McGinley**, Assistant Curator of Entomology, was an invited participant at the National Science Foun-

dation Workshop on the Theory and Application of Cladistic Methodology held at the University of California (Berkeley) in March.

A number of departures: Dr. **Robert E. Silberglied**, Associate Professor of Biology and Associate Curator of Lepidoptera, leaves the MCZ in June; he will continue his research at the Smithsonian Tropical Research Institute on Barro Colorado Island, Republic of Panama. Dr. **David Crews**, Associate Professor of Biology and Psychology, will take up a position at the University of Texas next January. Dr. **Vaughan Langman**, Postdoctoral Fellow at the Concord Field Station, will become Assistant Professor of Physiology at Wellesley College in September. He also received a Fulbright scholarship to study infant mortality and reproductive success in black rhino in Kenya. **Mary Keeler**, who served the MCZ Library in a number of valuable capacities for nearly ten years, most recently as conservator of rare books, left in March to work in the Harvard Business School Alumni Office, planning class reunions. Dr. **Katherine Muzik**, Associate in Invertebrate Zoology, has accepted the position of Marine Biologist/Visiting Scholar at Suntory Institute for Bioorganic Research. She will be studying octocoral natural history in Okinawa and the Great Barrier Reef.



Dr. Geoffrey Goldspink



# Concord Field Station Cuts Back on Energy Use. . .

While researchers at the Concord Field Station are usually concerned with the energy costs of animal locomotion, Director C. Richard Taylor has recently also conquered a different kind of energy problem—the taming of the Concord Field Station's galloping rate of consumption of electricity and heating oil.

Eighteen air conditioners have been replaced by eighteen ceiling fans, which not only use one-tenth of the electricity but also make the air far more comfortable, replacing artificially chilled air with cooling country breezes.

The heating oil bill has been reduced by two-thirds (from 11,500 to 4,000 gallons a year for the main building) by installing more controls so that areas are only heated when in use. The conversion cost of \$8,000 will almost be recouped in a single year. Installing a separate hot water heater rather than heating water from the furnace has also contributed to substantial savings over the summer months.



One of eighteen new electric ceiling fans which have replaced air conditioners at the Concord Field Station.



Handsome wood sign which now graces the front entrance was hand-carved by Dr. Ted Goslow of the University of Northern Arizona and presented to the Concord Field Station as a token of his appreciation. The CFS logo of a mouse, a horse, and a cheetah galloping symbolizes the many locomotion studies conducted at the Field Station.

## But Not On Productivity

A seven-year cycle of physiology studies at the Concord Field Station is being completed resulting in a large number of publications on a variety of topics. A recent publications list from 1974-1981 includes 71 papers by 54 researchers, in various combinations, on such diverse topics as:

*Sweating from the foot-pad of hyrax during exercise: is its function to increase friction?* (Jerusalem Satellite Symposium on Environmental Physiology, 1974)

*Why do Bedouins wear black robes in hot deserts?* (Nature 283:373-375)

*Elastic energy storage in the hopping of kangaroo rats.* (Journal of Zoology)\*

In 1980 and already in press for 1981 are 37 publications, the culmination of seven intensive years of research both at the Field Station and at collaborating laboratories including Ewald Weibel's in Berne, Switzerland, G. A. Cavagna's in Milan, Italy, and A. Shkolnik's in Tel Aviv, Israel. Dr. Taylor now anticipates the start of a new cycle of research with Dr. Ewald Weibel to try to determine whether or not animals are built rationally; i.e., whether they have just enough, but not too much, structure to meet functional needs.

\*The list and publications are available from the Concord Field Station, Old Causeway Road, Bedford, Massachusetts 01730 (617-275-1725).



# Invertebrates Find a New Home

Part of the MCZ's extensive collections of invertebrates, exclusive of insects, molluscs and echinoderms, were recently moved from the fifth floor of the MCZ Labs to newly-renovated, permanent quarters in the basement of the original MCZ building. The new quarters also include, on the first floor, offices, labs, a vivarium with

this, the containers of coelenterates were doubled up onto existing shelving. There will also be room for small acquisitions.

The major expenses of the renovation were borne by the University; however, the coelenterate compactor cabinets will be purchased with funds provided by the National Science Foundation's

Biological Research Resources Program. The MCZ's coelenterate collection, which includes unique acquisitions from the early ocean voyages by Louis and Alexander Agassiz and other seafarers of the late 1800's, is exceeded in size only by the Smithsonian in the United States, and is one of the ten finest such collections in the world.



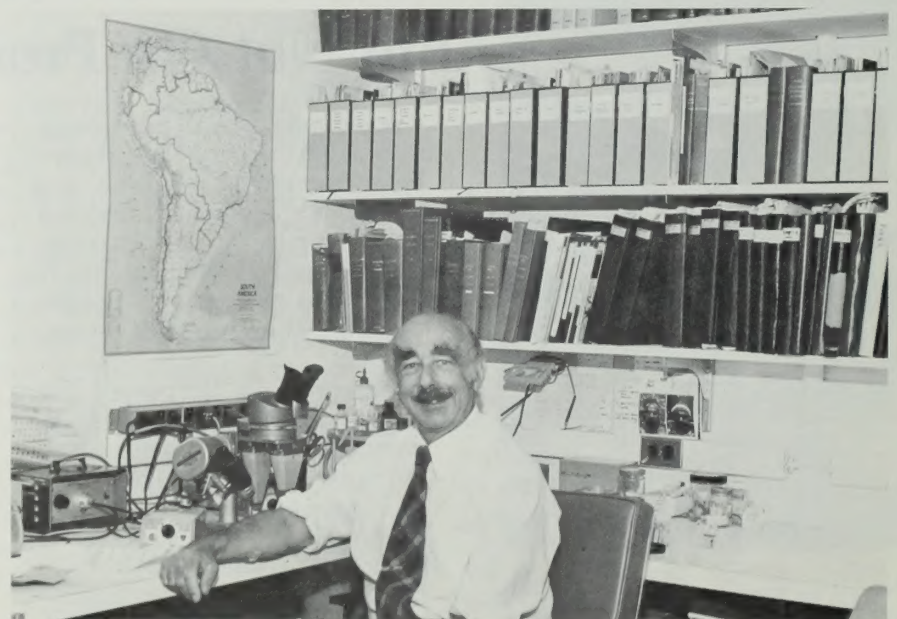
*Before . . .*

some temperature and humidity control, a photographic darkroom, and a seminar/conference area. Professor **Herbert W. Levi**, Curator in Arachnology, welcomes the increased research space, improved facilities, and enlarged visitor work areas as well as the room for expansion of coelenterate collections, thanks largely to a facilities grant from the NSF for compactor cabinets.

The collections total 500,000 to one million arachnids, including 3,000 type specimens (the original specimen for which a species was named), 50,000 crustaceans, and 150,000 coelenterates. With the installation of the compactor cabinets to house the coelenterates, there will be enough room to spread out these collections, making them more accessible to scholars. Prior to



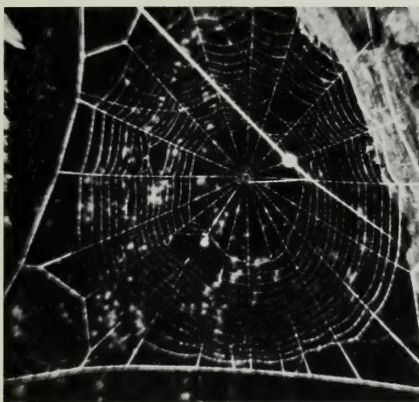
*After. Curatorial Associate Catharine Kessler and assistant John Hunter in the new curatorial office*



*Professor H. W. Levi in his new office*



# Student Spider Studies



*Orb-web of a theridiosomatid genus*

**Jonathan Roughgarden**, fourth-year graduate student, is studying the phylogeny and the evolution of web form in a family of small tropical spiders, the Theridiosomatidae. The primitive web form is a conventional orb-web (top left); the most specialized web is a comb-like structure in which the vertical tense strands literally are anchored to the surface of flowing streams (bottom left). The physical mechanism by which these vertical strands are attached to the water surface is not known (waterproof glue?). There are distinct advantages to capturing prey at the water surface. Not only are there numerous insects which normally move about on top of the water, but also many terrestrial insects accidentally fall onto the stream surface and are swept downstream to the waiting web.



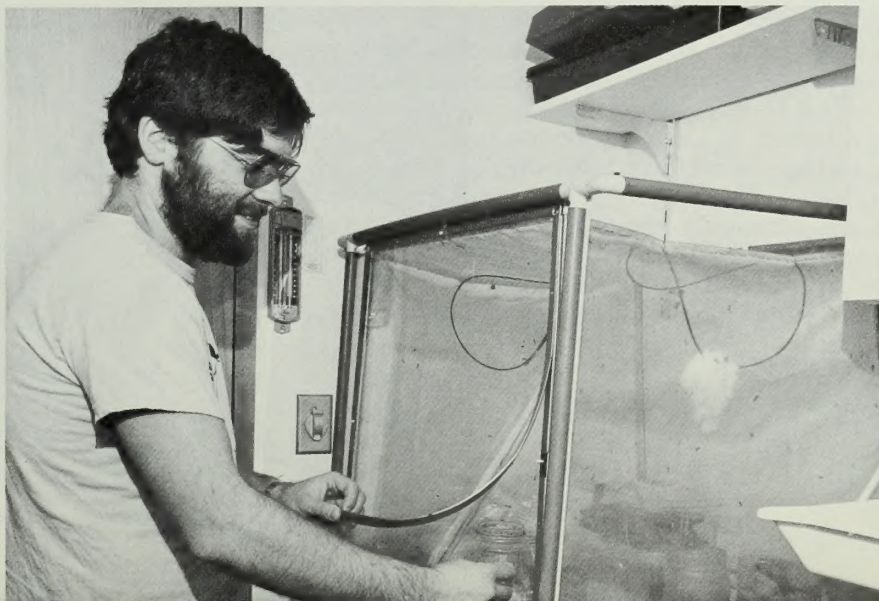
*Web attached to water surface (note reflections)*



*Jonathan Roughgarden*

**Mark Stowe**, a third-year graduate student, is working on a subfamily of spiders from California and Florida. These spiders attract the male moths they feed upon by mimicking the moth's sex pheromones. Rather than building a web, the spider catches the moth by dangling a line of silk with a drop of glue at the end and hurling it at the approaching prey (hence the common name "bolas" spiders).

The new vivarium in the Invertebrates Department allows Mark to raise spiders and moths for his aggressive chemical mimicry research.



*Mark Stowe tends his charges in the vivarium*

First year graduate student **Wayne Maddison** is interested in the salticids (jumping spiders), a family of spiders that creep up and pounce on their prey. They are diurnal and possess good vision. These spiders use their web-spinning abilities for building nests, and for spinning safety lines in case they lose their foothold while walking or jumping.



*A salticid, a male of *pellenes arizonensis**



*Wayne Maddison with part of his collection of live jumping spiders*



# Projects in Genetics

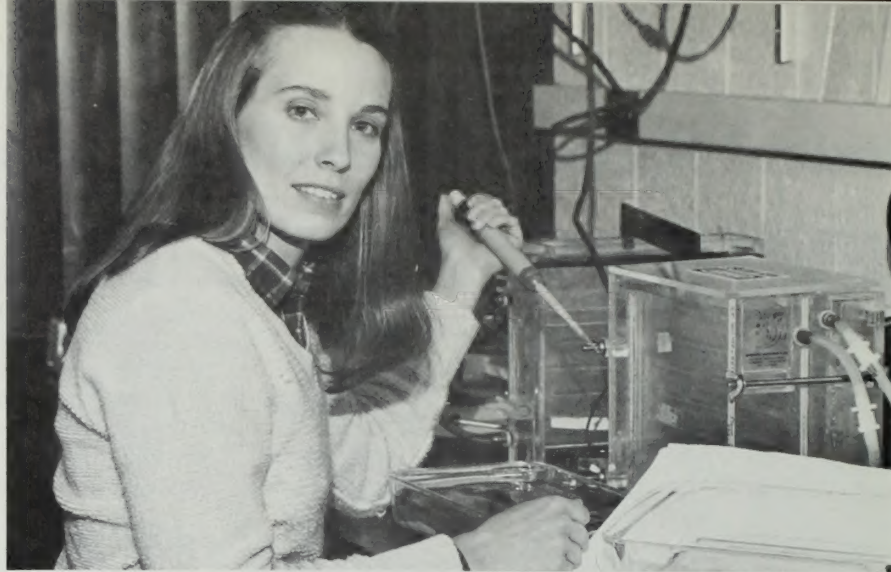
Three members of the Population Genetics group are breaking down the factors contributing to genetic variation on increasingly complex levels of organization: **Dave Parker's** cockroach studies look at the whole animal; **Tim Keith's** electrophoretic studies on two populations of fruitflies are at the protein level; and **Marty Kreitman's** work involves breaking down the proteins to determine the DNA sequence.



Dave Parker with several cockroaches including *Gromphadorhina*, a giant pet not used in his genetic studies.

Most cockroach species, including the ubiquitous German cockroach which is native to the Old World but now flourishes in many local kitchens, reproduce sexually. However, members of one species, *Pycnoscelus surinamensis* (from Indonesia), reproduce parthenogenically, making them an ideal subject for comparative studies. Postdoctoral fellow **Dave Parker** is looking at such factors as rate of development and age at maturity. Since all individuals of a parthenogenic clone are genetically identical and are easy to rear in the lab, they make convenient subjects for studying variation of single genotypes.

It is not known why some species evolve parthenogenesis;



Tim Keith with electrophoretic set up. Acrylamide gel is in dish.

there could be ecological advantages for not having genetic variation as in sexual species. These studies could eventually lead to a reassessment of fitness characteristics.

**Tim Keith**, fourth-year graduate student, is studying the genetic variation of the enzyme Esterase-5 in two populations of *Drosophila pseudoobscura*. Samples from two populations have been collected, one from the San Jacinto Mountains of southern California, and the other from the Sonoma Valley of northern California.

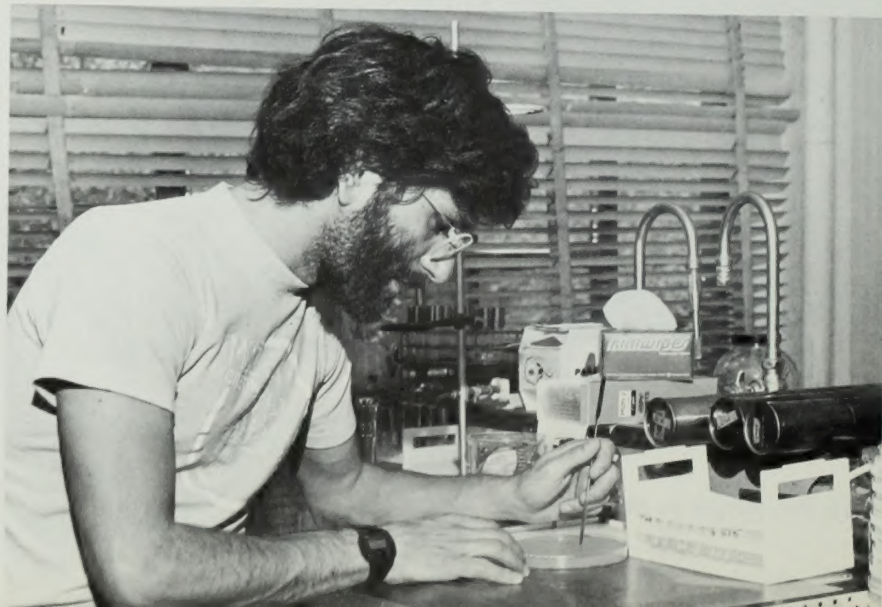
Using electrophoretic techniques first applied to population genetics by Hubby and Lewontin in 1966, Tim is comparing the number and frequency of alleles (genetic variants of an enzyme) in both populations to determine whether the great deal of observable variation is neutral or selective.

One of the major limitations of

electrophoresis is that it is impossible to determine whether all genetic variation has been detected. This can be overcome by analysing the nucleotide sequences of DNA that code for a particular protein. **Marty Kreitman**, third-year graduate student, has had the good fortune to be welcomed into Dr. Walter Gilbert's lab in Harvard's Biological Laboratories to learn this highly technical procedure. Dr. Gilbert received a Nobel Prize in 1980 for developing a technique to sequence DNA.

DNA cloning and sequencing is not only cerebral but requires a surgeon's physical dexterity, motor skills, patience, and care; it is truly a journeyman's trade that must be learned from another person. The work is also very slow and laborious. While Tim Keith can study several hundred samples in a year using electrophoresis, Marty can sequence the DNA of a dozen.

**Marty Kreitman** isolates recombinant virus plaques containing the alcohol dehydrogenase gene from *Drosophila melanogaster*.





# Collections Receive Federal Funds

Two of the MCZ's ten collections of major systematic groups, all of which rank high among the most important in the world, have recently received support from the National Science Foundation.

NFS's Systematic Biology Division five-years continuation grant to the Fish Department (designated one of the eight recognized International Centers in North America) assures that the high level of service to researchers, which has been achieved under the previous NSF

grants, will be maintained. Now that the major renovation and accession of the large Woods Hole collection have been completed, the new grant will support the Curatorial Associate, help with the purchase of necessary supplies, and partially support specialists to study recently-acquired groups of fishes.

A two-year continuation of the facilities grant to the Vertebrate Paleontology Department will allow for the sorting and transfer of

the fossil fish collections into modern metal cabinets. The grant will support the Curatorial Associate and cover the purchase of equipment and supplies. The MCZ's fossil fish collection, which was begun when Louis Agassiz brought over valuable material from Europe and subsequently added several important collections, represents a complete spectrum from the earliest vertebrates known to late Tertiary teleosts and is one of the MCZ's richest assets.

## Other Collections Are Hopeful

Two other collections have undergone major renovations with NSF support since 1973. They include the collections of reptiles and amphibians, and insects. Continuation grants to maintain the newly-achieved level of service have been submitted.

The Mammal Department, which now has a full-time associate curator, has submitted a request for support of a much-needed over-

haul. Plans for the five-year project include: moving the colony of dermestid beetles (used for the preparation of skeletons) and the collection of hides to the MCZ's Concord Field Station, freeing an entire room to accommodate needed redistribution of present specimens and the housing of new ones; renovating the primate room and the department office; and conducting a shelf-check of all specimens.

## Microcomputers Proliferating in the MCZ

While visiting various departments to survey the state of their collections for the preceding article, the editor was struck by a constant recurring theme. "Our collections are in fine shape now," was Dr. William L. Fink's (Fishes) assessment, "but don't leave without seeing our new *Apple*." The new *Apple* turns out to be a microcomputer which costs less than a used car and can not only take over tedious repetitive functions, such as updating bibliographies or remembering how to spell a five-syllable Latin name, but can also perform an impressive array of sophisticated tasks. Developed by two young men in their garage workshop, the phenomenally successful new microcomputer has

been popping up all over the museum this year.

The Fish Department's *Apple* includes a graphics tablet upon which Professor Karel F. Liem "draws" with an electronic "pen" to analyze body motion. Dr. Ronald J. McGinley's (Insects) *Apple* has been programmed to isolate a handful of possible identifications from an intimidating list of 700 species of one genus of small bees. The Fish and Insect Departments share a printer which produces "hard copy" for distribution to classes, publishers, and other likely targets.

"Would you like to play a game of tennis?" was the greeting of a graduate student in Dr. Kenneth P. Sebens' marine invertebrates lab.

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*Editor: Gabrielle Dundon  
Photographer: A.H. Coleman*

These *Apples* come with a variety of games which provide a remedy for research fatigue and an escape from small talk at department get-togethers. Dr. Sebens' graphics tablet is hooked up to a color monitor giving him the capability to produce color graphs for his population studies on colonies of marine invertebrates. These graphs can be photographed directly off the screen for use in teaching and for publication. The graphics tablet also measures specimens and, of course, commits all significant data to memory.

Dr. Stephen Jay Gould's *Apple* is attached to a digitizer that takes the tedium out of his and his students' research on the evolution of form. The digitizer can measure any two dimensional object, including lengths, area and perimeters. The data is fed directly into the *Apple* and processed automatically. Dr. Gould's group is studying rates of evolution in snails and foraminifera.

Dr. James J. McCarthy (Biological Oceanography) is finding his *Apple*

*(Continued on page 8)*



## Friendly Whales

The Friends of the MCZ Baja trips were better than ever this year—friendly calves and their watchful mothers swam right alongside the skiffs in San Ignacio lagoon. This trusting behavior has increased markedly since the first Baja trips in the mid-1970's. When patted, especially near the blowhole, they often closed their eyes, not unlike a cat or a dog. The Friends were so enchanted that they even tolerated being on the wet end of an occasional "blow"; camera equipment, however, required constant protection.

*Hand on whale; notice whale lice by blowhole*



Photo by Walter J. Gamble

*A particularly affectionate gray whale calf.*

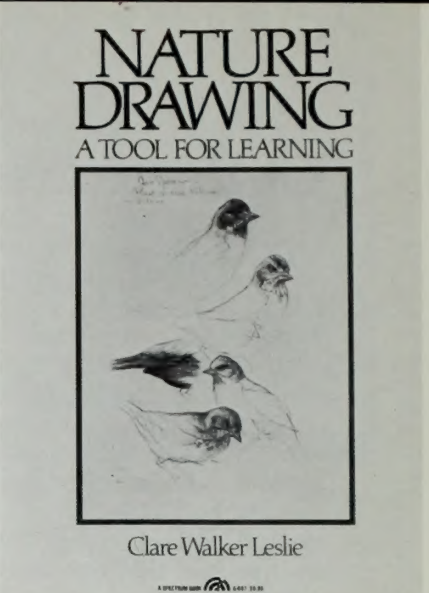


Photo by Bruce Wellman

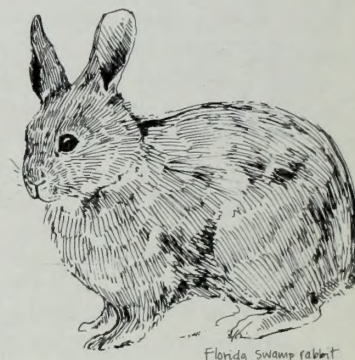
## Natural History Illustration

Clare Walker Leslie has joined the illustration staff to teach a new course this fall. The course is designed for those who wish to improve their drawing skills as well as their skills of observing the natural world immediately around them. Sessions will concentrate on studying and drawing those plants and animals specific to the New England area in the fall.

A professional artist, naturalist, and teacher Clare Walker Leslie has developed courses and workshops throughout the New England area, combining the study of drawing



and nature. Her book, *Nature Drawing: A Tool for Learning* is a highly-acclaimed text now being used internationally.



(Microcomputers from page 7)

so useful that he is considering acquiring another one next year. One Apple is apparently not enough to go around in a busy department.

All these microcomputers have the potential to be hooked up to Harvard's central computer system, giving access to far greater storage capacity, if needed.

While Apples are certainly the most popular new acquisition around the MCZ's research labs these days, other computer options are also being explored. Dr. John A. W. Kirsch would like to tie in with the Herbarium's larger Onyx minicomputer for collection record-keeping in the Mammal Department and a word-processor which can produce camera-ready copy was a more appropriate choice for Dr. Raymond A. Paynter, Jr. of the Bird Department for the production of *Ornithological Gazetters for the Neotropics* and Peters' *Check-list of Birds of the World*.



